

REMARKS

This is in response to the Office Action mailed on February 2, 2006 in which claims 1, 3-12, 14-17 and 29-38 were rejected. With this Amendment, claims 3, 5, 8, and 11 are amended. Claims 1, 3-12, 14-17 and 29-38 are pending in this application.

Claim Rejections under 35 U.S.C. § 112

In the Office Action, claims 3-5 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. With this Amendment, claims 3 and 5 have been amended to properly depend from independent claim 1. In addition, claim 4 depends from amended claim 3.

Claims 3 and 5 were also rejected under 35 U.S.C. § 112, second paragraph for lack of antecedent basis of the phrase "the oxidized titanium alloy." With this amendment, claims 3 and 5 have been amended to properly recite "titanium alloy oxide" as suggested in the Office Action.

Claim 5 was rejected under 35 U.S.C. § 112, second paragraph for a misspelling of the word "hafnium." With this amendment, the spelling has been corrected.

Claim 8 was rejected under 35 U.S.C. § 112 as being indefinite for referring to the line in FIG. 6, because many lines are shown in FIG. 6. With this amendment, claim 8 has been amended to eliminate reference to a Figure. Therefore, the rejection to these claims under §112 is overcome and a notice to that effect is requested.

Claim Rejections - 35 U.S.C. § 102

In the Office Action, claims 1, 3, 5-12, 14-16, 29-35, and 37-38 were rejected under 35 U.S.C. § 102(e) as being anticipated by the Kreupl patent (U.S. Patent No. 6,777,731). Specifically, the Office Action references col. 11, lines 30-36 to assert that the Kreupl patent teaches a tunneling magnetoresistive stack that exhibits a negative exchange coupling between the first and second ferromagnetic layers, as recited in independent claims 1 and 11.

Contrary to the assertion in the Office Action, the Kreupl patent does not teach or suggest negative exchange coupling. Col. 11, lines 30-36 states that the "magnetization direction of the memory layer 3 is directed in the same direction as or in the opposite direction to the magnetization direction of the reference layer 5, depending on a data content of the memory cell 1." The magnetization direction of the memory layer with no external field applied (a quiescent

state) is dependant upon data content not on negative exchange coupling. The dependency of the magnetization direction based on data content is further described at col. 1, lines 31-50. In essence, the orientation of magnetization flips dependant upon the "data" that is written to the memory layer of the memory cell. This variable magnetization orientation during a quiescent state is not the same as negative exchange coupling.

Negative exchange coupling relates to the magnetization direction of the free layer with respect to a pinned layer in the absence of an applied magnetic field (or in the presence of a very small magnetic field). FIG. 4 illustrates a magnetoresistive stack having negative exchange coupling. In this case, the magnetization direction of free layer 22 is antiparallel to the magnetization direction of pinned layer 26 in the absence of an applied magnetic field ($H_{APPLIED} = 0$). The magnetization direction of the free layer in the absence of an applied magnetic field is always antiparallel to the magnetization direction of the pinned layer. It does not flip.

The Kreupl patent does not disclose a tunneling magnetoresistive stack that exhibits negative exchange coupling, as recited in independent claims 1 and 11. In addition, claim 29 recites a tunneling magnetoresistive stack including a first ferromagnetic layer and a second ferromagnetic layer, the magnetization direction of the second ferromagnetic layer being opposite the magnetization direction of the first ferromagnetic layer in the absence of an applied magnetic field. The device described by Kruepl does not have a magnetization direction being opposite in the absence of an applied magnetic field. Rather, the device described by Kruepl has a magnetization direction that flips depending upon the data content of the memory layer. Therefore, claims 1, 11, and 29 are in condition for allowance and the rejection of claims 1, 11, and 29 under 35 U.S.C. § 102 should be withdrawn.

Likewise, dependent claims 3, 5-10, 12, 14-16, 30-35, and 37-39 all depend from one of independent claims 1, 11, and 29 and are also in a condition of allowance.

Claim Rejections - 35 U.S.C. § 103

Claims 4, 17, and 36 were rejected under 35 U.S.C. § 103(a) as being obvious over the Kreupl patent in view of the Chen patent (U.S. Patent No. 6,183,859). Dependant claims 4, 17, and 36 depend respectively from claims 1, 11, and 29. As explained above, each

independent claim requires negative exchange coupling. Neither Kreupl nor Chen describe two ferromagnetic layers separated by a tunnel barrier layer comprising a titanium alloy oxide, wherein the tunneling magnetoresistive stack exhibits a negative exchange coupling between the two ferromagnetic layers. Since, the claimed limitation is neither shown or described by Kreupl or Chen, dependent claims 4, 17, and 36 are not obvious over Kreupl in view of Chen and a notice to that effect is respectfully requested.


Conclusion

In view of the foregoing, this application containing pending claims 1, 3-12, 14-17, and 29-38 is in condition for allowance. Reconsideration and notice to that effect is respectfully requested.

Respectfully submitted,

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